Limited Circulation

This is not an official document : it is for information only and must not be quoted in any printed publication.

Agricultural Memorandum No. 1075

The Frequency of Easterly Winds in Winter* and Their Impact on Agriculture

I A Barrie

"There should also, perhaps, be a wall to the east to defend tender shrubs from the piercing blasts from that quarter"

Gilbert White, 1788

Summary

During January and February easterly winds bringing continental air from mainland Europe are invariably cold and often dry, although outbreaks of snow can be experienced, especially on the east coast or on the northern edge of depressions moving along the English channel. An analysis of hourly wind records between 1961 and 1986 show that the frequency of easterly winds is very variable both from place to place and from year to year. The eastern coast of England is particularly exposed and periods of easterly winds above 10 knots (5 m/s) often total over 200 hours during January and February (median = 168 hours). Normally the frequency of these stronger winds decreases quickly inland (where the nocturnal backing and decrease of the speed is more marked) so the corresponding totals at Shawbury (Shropshire) seldom exceed 100 hours (median = 23 hours).

In this memorandum the effect of these easterly winds is discussed with special reference to the unusually widespread and severe conditions in 1986 and their impact on a diverse range of agricultural activities.

* Note - For the purpose of this memorandum "Easterly" refers to winds from between NE and SE (050° and 130°) measured 10m above ground level. Only January and February are considered.

INTRODUCTION

Persistant and very cold easterly winds have adversley affected a wide range of agricultural and horticultural enterprises during both 1985 and 1986. A study of past February weather records from Edgbaston, Birmingham for 1941 to 1986 show that, in terms of both mean temperature and wind chill, February 1986 was "an exceptionally cold month" with only February 1947 recording more severe conditions (Giles, 1986). Among the most seriously affected enterprises have been:-

1. Plant Nurseries

where inadequate wind protection resulted in widespread desiccation and mortal injury to plants of all ages (Morgan et al, 1985).

2. Bulk Potato Stores

where accurate temperature control is vital (MAFF, 1983), suffered to the extent that reports of severe frost damage to the bulk were common place.

3. Pig Units

where naturally ventilated finishing houses experienced long periods several degrees below the target temperatures (Barrie and Smith, 1986), and pig weaner rooms where inadequate insulation or heating caused scouring and mortalities (Barrie and Goodwin, unpublished data).

Counter measures can be taken to reduce the impact of any adverse weather but the cost is frequently high. The decision to undertake any counter measure must be weighed against the expected frequency of such events.

The Geographical Variation of Easterly Winds in Winter

A study was made of the hourly mean wind speed and direction records of four long established Meteorological stations in arable areas of the country, Manston (E Kent), Wattisham (Suffolk), Finningley (N Notts) and Shawbury (Shropshire).

Table 1 shows the monthly mean percentage of hours when the wind direction was between 50 and 130° from North during the period 1971-85.

TABLE 1 - Mean Percentage Frequency of "Easterly" Winds

	Manston			Wattisham			Finningley			Shawbury		
Speed (Knots)	Jan	Feb	J+F	Jan	Feb	J+F	Jan	Feb	J+F	Jan	Feb	J+F
0-10	-	-	8.5	6.9	18.5	12.4	5.9	20.0	12.6	11.3	29.2	19.8
>10	-	-	11.8	4.6	8.6	6.5	2.4	3.7	3.0	2.1	2.9	2.5
Total*	-	-	20.3	11.5	27.2	18.9	8.3	23.5	15.5	13.5	32.1	22.3

* Subject to rounding differences

From table 1 it can be seen that between sites the total percentage of all hours during January and February is broadly similar with a four station mean of 19.3% (=273 hours) and a range of 15.5% (Finningley) to 22.3% (Shawbury). However, the percentage of hours with speeds greater than ten knots shows a clear progression from a maximum of 11.8% (Manston) to a minimum of 2.5% (Shawbury). There is also a marked difference between the months with February recording between 40 and 90% more hours of stronger winds than January.

The Year to Year Variation of Easterly Winds in Winter

For two of the meteorological offices a study was made of the variation between years (including 1986) in order to ascertain the extremes which may be expected over much of England (table 2).

TABLE 2 - Yearly Percentage of "Easterly" Winds (Jan and Feb)

	Manston			Shawbury		
	0-10 Knots	⩾ 10	Total*	0-10	⩾ 10	Total*
1971	7.5	4.4	12.1	-	-	-
72	13.1	16.4	29.6	-	-	-
73	7.7	6.4	14.2	7.7	0.1	7.8
74	3.7	3.9	7.6	8.1	0.8	8.9
75	11.9	13.1	25.0	22.7	0.6	23.3
76	11.7	11.1	22.7	18.6	5.8	23.5
77	3.6	5.4	9.0	22.3	3.6	26.0
78	2.0	12.7	14.7	15.5	4.1	19.5
79	8.2	20.5	28.8	27.8	10.9	38.6
80	8.4	8.9	17.4	18.4	1.8	20.2
81	7.2	9.2	16.5	17.0	0.8	17.9
82	10.7	15.5	26.1	29.8	1.4	31.2
83	5.6	17.8	23.5	19.8	1.1	20.8
84	8.6	9.9	18.5	15.5	0.6	16.1
85	18.1	21.6	39.5	33.6	3.2	36.8
86	17.6	21.8	39.2	24.9	13.5	38.4
Mean	9.1	12.4	21.5	20.1	3.5	23.5
St dev	4.6	6.0	9.6	7.5	4.1	9.9
Highest	18.1	21.8	39.5	33.6	13.5	38.6
Lowest	2.0	3.9	7.6	7.7	0.1	7.8

* Totals are subject to rounding differences when derived from the original data.

From table 2 it can be expected that exposed coastal sites, similar to Manston, will on average experience easterly winds of at least 10 knots for 11.9% of hours (median = 168 hours) and for one year in four the total will exceed 17.1% (upper quartile = 242 hours). In contrast Shawbury will average only 1.6% of hours (median = 23 hours) and for one year in four the total will exceed 4.1% (58 hours).

Along the east coast during January and February 1986 the frequency of easterly winds above 10 knots was high (see table 2 and fig 1*) with 21.8% of hours (= 309) which is about 30% more than the upper quartile. However, the extent to which these winds prevailed inland was remarkable with well over 20% of hours recorded in most of central and southern England, and Shawbury with 13.5% of hours, recorded a total which was over three times the upper quartile value. This easily exceeded the previously recorded maximum of 10.9% in 1979. Coastal districts, other than in eastern countries, were also severely affected as shown in the data from Lancashire, Glamorgan and Devon (fig 1).

CONCLUSIONS

The frequency of easterly winds with speeds of at least 10 knots, may be expected to be high in most years in eastern counties and especially along the coast. Further inland the frequency falls away rapidly and only the remarkable winters such as 1979 and 1986 are liable to cause severe cold weather problems to so many activities.

Remedial measures should be assessed accordingly. Relatively inexpensive measures such as planting shelter belts around nurseries to reduce losses through desiccation, or in bulk potato stores where a stronger wind speed will more rapidly cool the store by conduction and infiltration, can be recommended for most regions. Comprehensive instruction on the construction and siting of shelter belts, which can reduce windspeeds by up to 60%, can be found in MAFF (1985). More expensive capital installations such as specially modified ACNV systems in pig buildings which could operate east and west facing flaps independantly are more suited to eastern counties.

For any particular enterprise a specific analysis similar to those given above can be produced prior to work commencing.

Any comments or suggestions should be referred to the author.

* Fig 1 - Local variations at Hurn, where there was a high proportion of winds from the NNE and Wattisham where winds were generally lower than surrounding stations, do not obviously fit in with the national picture.

MET UNIT
MAFF, ADAS
Wolverhampton
September 1986

Key Words : Wind, Desiccation, Chilling

REFERENCES

Barrie I A and Smith A T, 1986. Winter Temperature Profiles in Pig Buildings Incorporating Modified ACNV. BSAP Occasional Meeting.

Giles B D, 1986. Exceptionally Severe Weather : A Problem for the DHSS. The Situation in February 1986. Weather 41, No. 7, pp 226-229.

MAFF, 1983. Management of Ware Potato Stores. ADAS Leaflet 2099.

MAFF, 1985. Windbreaks for Horticulture, Booklet 2280.

Morgan B and George W, 1985. ADAS Nursery Stock Technical Note No. 8, "Winter Damage Special" (SE Region).

White, G, 1788. The Natural History of Selbourne.

Fig 1

Percent of Hours in Jan & Feb 1986 with Easterly Winds ≥ 10 knots.